

## Article

# **An age- and cause-decomposition of differences in life expectancy between residents of Inuit Nunangat and residents of the rest of Canada, 1989 to 2008**

by Paul A. Peters

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- |     |  |
|-----|--|
| .   | not available for any reference period   |
| ..  | not available for a specific reference period  |
| ... | not applicable   |
| 0   | true zero or a value rounded to zero   |
| 0*  | value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded |
| p   | preliminary  |
| r   | revised  |
| X   | suppressed to meet the confidentiality requirements of the <i>Statistics Act</i>                                   |
| E   | use with caution   |
| F   | too unreliable to be published   |
| *   | significantly different from reference category ( $p < 0.05$ )   |

# An age- and cause-decomposition of differences in life expectancy between residents of Inuit Nunangat and residents of the rest of Canada, 1989 to 2008

by Paul A. Peters

## Abstract

### Background

This study quantifies differences in life expectancy between residents of Inuit Nunangat and people in the rest of Canada: estimates the contribution of specific causes of death to the differences; and examines these differences over time, by sex and by age group.

### Data and methods

A geographic approach was used to decompose differences in life expectancy for residents of Inuit Nunangat, compared with people living outside this geographic area. Differences in life expectancy by cause, sex, and age group were calculated using the discrete method of decomposition and were applied to abridged life tables. Causes of death were classified according to Global Burden of Disease categories. Attributable causes of death were calculated for causes amenable to medical intervention and for smoking-related diseases.

### Results

The largest contributor to life expectancy differences between males in Inuit Nunangat and the rest of Canada was injury, particularly self-inflicted injury at ages 15 to 24. For females, the largest contributors were malignant neoplasm and respiratory disease at ages 65 to 79.

### Interpretation

The gap in life expectancy between residents of Inuit Nunangat and the rest of Canada can be attributed to specific groups of causes occurring within specific age ranges.

### Keywords

Aboriginal, cause of death, death rate, indigenous, longevity, mortality

### Author

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Life expectancy in Canada has risen steadily over the past few decades and is among the highest in the world.<sup>1</sup> However, increases in longevity and decreases in mortality are not equal for all population groups or regions.<sup>2</sup> In particular, mortality rates in high-percentage Aboriginal areas are elevated for a range of diseases and injuries.<sup>3-5</sup>

Previous research has shown that life expectancy for residents of Inuit Nunangat has been consistently lower than that estimated for people in the rest of Canada, while mortality and morbidity have been higher.<sup>3,4,6-9</sup> This paper addresses these differences by examining the causes of death and age groups that contribute to the persistent differences in health outcomes.

Identifiers of Inuit identity or ancestry are not uniformly available on vital statistics records for all regions and periods. Therefore, a geographic approach was used to analyse the entire population of the Inuit Nunangat region,<sup>10</sup> where the majority of Inuit in Canada live.<sup>11</sup>

Life expectancy is only one indicator of population health, but it is especially useful, given its flexibility in describing the health of individuals in a population.<sup>12</sup> This analysis presents a decomposition of life expectancy in

order to determine what causes of death and what age groups contributed to the gap in life expectancy between residents of the Inuit Nunangat region and people in the rest of Canada over the 1989-to-2008 period. The decomposition method is easily interpretable, and the results are comparable to other population groups in Canada and to results for other countries.

## Methods

The lack of uniformly available Inuit identifiers on vital statistics records has limited analysis of this population subgroup.<sup>13</sup> To overcome this limitation, a geographic approach was adopted in this study, whereby deaths in the Inuit Nunangat region were compared with those occurring in the rest of Canada.<sup>5,10,14</sup> In 2006, almost 40,000 people reporting Inuit identity lived in the four regions of Inuit Nunangat: the Inuvialuit Region,

# An age- and cause-decomposition of differences in life expectancy between residents of Inuit Nunangat and residents of the rest of Canada, 1989 to 2008 • Research Article

Nunavut, Nunavik, and Nunatsiavut (Figure 1). Inuit comprise approximately 78% of the population in Inuit Nunangat,<sup>9</sup> although the percentage of the total population identifying as Inuit varies in each region.<sup>9</sup>

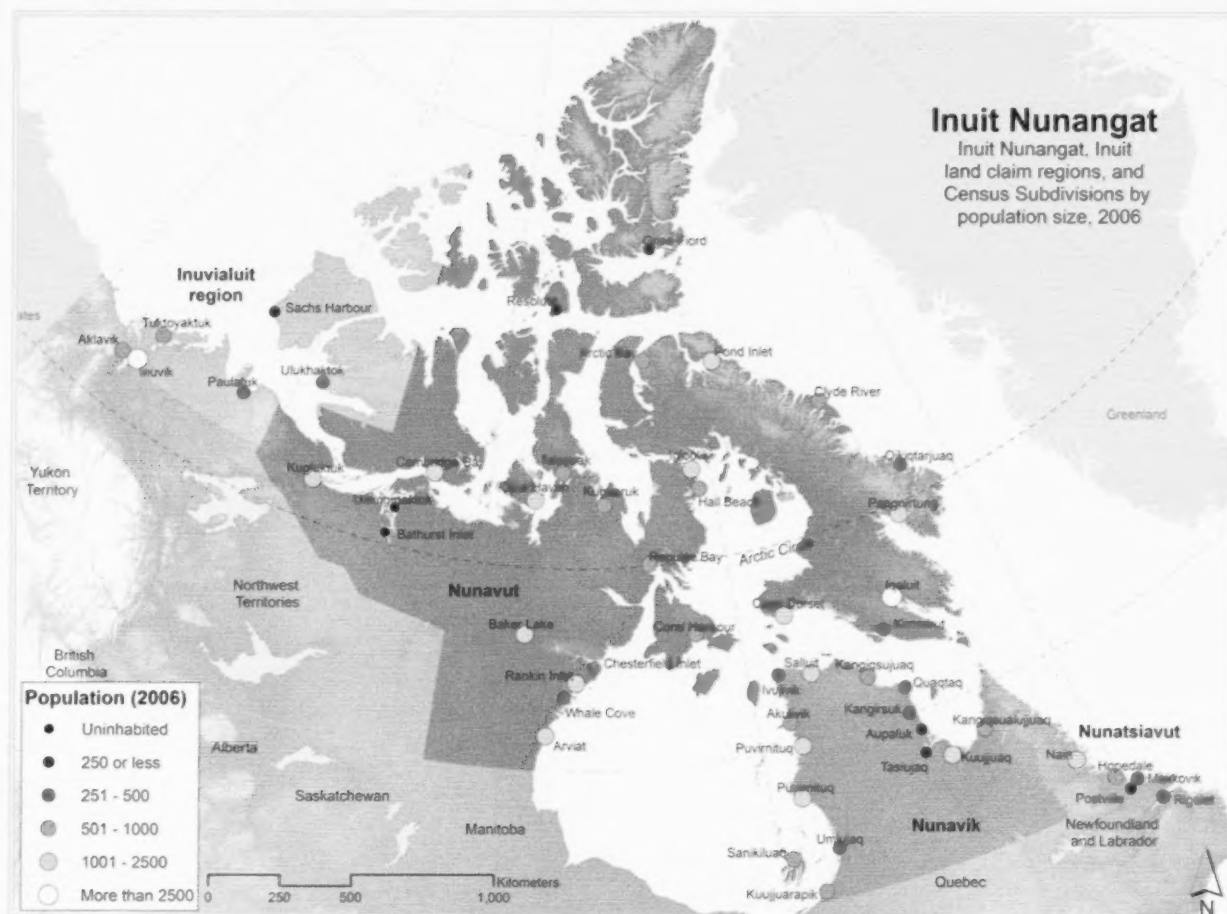
Vital statistics death records and census population estimates were used to calculate life expectancy. Person-years-at-risk were estimated from detailed population age-sex estimates where available (1996 to 2006), and from mid-year census population counts (1989 to 1995, 2007 to 2008). Deaths were compiled based on usual place of residence, regardless of where the death occurred,

and across five-year periods, with the mid-year of these periods centred on the quinquennial census year.

Causes of death were classified according to the Global Burden of Disease (GBD) framework, based on codes from the *International Classification of Diseases, 9th and 10th Revisions* (ICD-9 and ICD-10).<sup>15</sup> The GBD framework was chosen because its aggregation of deaths is more relevant than clinical divisions and reflects socio-economic development and the epidemiological transition stage of Aboriginal peoples.<sup>12,16</sup> The GBD classification defines three broad groups: Group I – communicable

diseases, maternal causes, perinatal conditions and nutritional deficiencies; Group II – non-communicable diseases; and Group III – intentional and unintentional injuries. As well, cause-of-death categories were created for smoking-related diseases and causes amenable to medical intervention.<sup>9,17</sup> The smoking-related deaths category comprises cancers of the buccal cavity, cancer of the pharynx and esophagus; cancer of the larynx, cancer of the trachea, bronchus, and lung; and other cardio-pulmonary (COPD) deaths. Deaths amenable to medical care were tuberculosis, other infectious and parasitic diseases, breast

**Figure 1**  
Inuit Nunangat, Inuit land claim regions, and Census Subdivisions, by population size, 2006



Source: 2006 Census Geography, Statistics Canada. Produced by the Health Analysis Division.

*An age- and cause-decomposition of differences in life expectancy between residents of Inuit Nunangat and residents of the rest of Canada, 1989 to 2008 • Research Article*

cancer, cancer of cervix uteri, Hodgkin's disease and leukemia, hypertension, cerebrovascular disease, pneumonia, influenza, appendicitis, hernia, peptic ulcer, cholecystitis, lithiasis, and maternal deaths.

Abridged life tables were constructed according to the revised Chiang method, along with associated variances, standard errors and 95% confidence intervals.<sup>18</sup> The value of  $a$  (average person-years lived in the interval divided by those dying in the interval) was set to 0.1 for the youngest age group to reflect high infant mortality, and to 0.5 for all other age groups. The revised method differs in the calculation of the standard error by allowing for 0 deaths in a given age group, as calculation of the variance of the probability of death ( $var(qx)$ ) involves multiplying by the mortality rate. This option is preferred for small areas, as opposed to imputing values into age bands with 0 deaths.<sup>19</sup>

Differences in life expectancy at birth by age group were calculated using the Arriaga II discrete method of decomposition and applied to abridged life tables,<sup>20,21</sup> in order to determine which age- and cause-specific mortality differences were major contributors to the total difference in life expectancy between the residents of Inuit Nunangat and people in the rest of Canada. The total effect ( $n \cdot lx$ ) for a given age group was calculated as the contribution of mortality difference in an age group ( $x$  to  $x+n$ ) to differences in life expectancies at birth between the two populations.<sup>21,22</sup> Confidence intervals are not calculated for this technique, because more research is needed to provide appropriate intervals.<sup>23</sup>

## Results

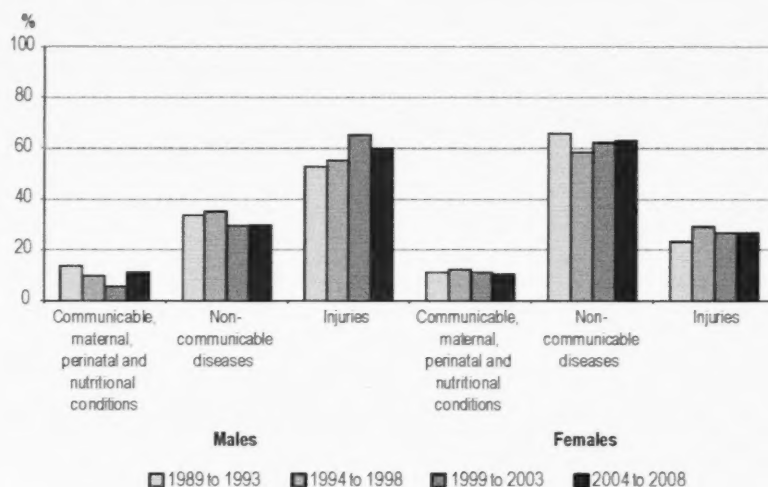
Over the past two decades, life expectancy rose for residents of Inuit Nunangat and for people in the rest of the country (Table 1). Among males in Inuit Nunangat, the increase was from 63.5 years for 1989 to 1993 to 67.7 years for 2004 to 2008; among females, the corresponding increase was from 71.1 to 72.8 years. At the same time, life expectancy

**Table 1**  
Life expectancy at birth, by sex, Inuit Nunangat and rest of Canada, 1991, 1996, 2001 and 2006

|                     | Inuit Nunangat |                               |      | Rest of Canada |                               |      | Difference<br>(years) |
|---------------------|----------------|-------------------------------|------|----------------|-------------------------------|------|-----------------------|
|                     | Years          | 95%<br>confidence<br>interval |      | Years          | 95%<br>confidence<br>interval |      |                       |
|                     |                | from                          | to   |                | from                          | to   |                       |
| <b>Both sexes</b>   |                |                               |      |                |                               |      |                       |
| 1991 (1987 to 1993) | 67.3           | 66.4                          | 68.2 | 76.9           | 76.9                          | 76.9 | 9.6                   |
| 1996 (1994 to 1998) | 67.9           | 67.1                          | 68.8 | 77.6           | 77.6                          | 77.6 | 9.7                   |
| 2001 (1999 to 2003) | 67.4           | 66.6                          | 68.2 | 78.6           | 78.6                          | 78.7 | 11.2                  |
| 2006 (2004 to 2008) | 70.2           | 69.4                          | 70.9 | 79.5           | 79.4                          | 79.5 | 9.3                   |
| <b>Males</b>        |                |                               |      |                |                               |      |                       |
| 1991 (1989 to 1993) | 63.5           | 62.2                          | 64.8 | 74.1           | 74.1                          | 74.2 | 10.6                  |
| 1996 (1994 to 1998) | 64.7           | 63.5                          | 65.8 | 75.1           | 75.1                          | 75.1 | 10.5                  |
| 2001 (1999 to 2003) | 65.0           | 63.9                          | 66.1 | 76.5           | 76.4                          | 76.5 | 11.5                  |
| 2006 (2004 to 2008) | 67.7           | 66.7                          | 68.7 | 77.5           | 77.5                          | 77.6 | 9.9                   |
| <b>Females</b>      |                |                               |      |                |                               |      |                       |
| 1991 (1989 to 1993) | 71.1           | 69.8                          | 72.3 | 79.7           | 79.6                          | 79.7 | 8.6                   |
| 1996 (1994 to 1998) | 71.6           | 70.4                          | 72.9 | 80.1           | 80.0                          | 80.1 | 8.4                   |
| 2001 (1999 to 2003) | 70.0           | 68.9                          | 71.1 | 80.7           | 80.7                          | 80.8 | 10.7                  |
| 2006 (2004 to 2008) | 72.8           | 71.7                          | 73.9 | 81.3           | 81.3                          | 81.4 | 8.5                   |

Source: Person-years at risk pooled from mid-period census populations, 1989 to 1993; person-years at risk from annual demographic estimates, 1994 to 2008; deaths 1989 to 2008 from Vital Statistics Database, Deaths.

**Figure 2**  
Percentage contribution to difference in life expectancy at birth between Inuit Nunangat and rest of Canada, by sex and Global Burden of Disease Group, 1989 to 1993, 1994 to 1998, 1999 to 2003, and 2004 to 2008



Source: Person-years at risk pooled from mid-period census populations, 1989 to 1993; person-years at risk from annual demographic estimates, 1994 to 2008; deaths 1989 to 2008 from Vital Statistics Database, Deaths.



# **An age- and cause-decomposition of differences in life expectancy between residents of Inuit Nunangat and residents of the rest of Canada, 1989 to 2008 • Research Article**

for males living elsewhere in Canada rose from 74.1 to 77.5 years, and for females, from 79.7 to 81.3 years.

The differences in life expectancy between residents of Inuit Nunangat and the rest of Canada persisted throughout the period. For both sexes combined, the gap was 9.6 years for 1989 to 1993, and 9.3 years for 2004 to 2008. Although life expectancy for residents of Inuit Nunangat was lower for males than for females, the differences compared with the rest of Canada were similar for both sexes.

Using decomposition techniques, the gap in life expectancy was examined by detailed cause of death. Based on just the primary cause of death groupings from the Global Burden of Disease, clear differences emerged between the sexes (Figure 2). For males, the largest contributor to the gap in all periods was Group III (injuries). By contrast, for females, the largest contributor to the difference was Group II (non-communicable diseases).

The prominent role of injuries in the male life expectancy gap largely reflects

deaths from self-inflicted injuries, which accounted for 23% of the difference for 1989 to 1993, and 31% for 2004 to 2008 (Table 2). The second leading contributor to the male life expectancy gap was unintentional injury, contributing 19% in 2004 to 2008. For non-communicable diseases, deaths from malignant neoplasms were a major component of the difference in all periods. Smoking-related diseases accounted for 19% of the difference in 1989 to 1993, but fell to 13% in 2004 to 2008. Medically

**Table 2**

**Contribution (years and percentage) to difference in life expectancy at birth in Inuit Nunangat and rest of Canada, by sex and detailed cause of death, 1989 to 1993, 1994 to 1998, 1999 to 2003, and 2004 to 2008**

|   | 1989 to 1993 |              | 1994 to 1998 |              | 1999 to 2003 |              | 2004 to 2008 |              |
|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
|   | Years        | %            | Years        | %            | Years        | %            | Years        | %            |
| <b>Males</b>  |              |              |              |              |              |              |              |              |
| <b>Total difference (percent)</b>   | <b>10.6</b>  | <b>(100)</b> | <b>10.5</b>  | <b>(100)</b> | <b>11.5</b>  | <b>(100)</b> | <b>9.9</b>   | <b>(100)</b> |
| <b>Group I: Communicable, maternal, perinatal, and nutritional conditions</b> | <b>1.3</b>   | <b>(13)</b>  | <b>0.9</b>   | <b>(9)</b>   | <b>0.5</b>   | <b>(5)</b>   | <b>0.9</b>   | <b>(9)</b>   |
| Respiratory infections  | 0.6          | (5)          | 0.4          | (4)          | 0.2          | (1)          | 0.1          | (1)          |
| <b>Group II: Non-communicable diseases</b>                                    | <b>3.3</b>   | <b>(31)</b>  | <b>3.3</b>   | <b>(32)</b>  | <b>3.0</b>   | <b>(26)</b>  | <b>2.5</b>   | <b>(25)</b>  |
| Malignant neoplasms   | 1.8          | (17)         | 1.4          | (13)         | 1.4          | (12)         | 1.1          | (12)         |
| Trachea, bronchus, and lung cancers   | 1.3          | (12)         | 0.6          | (6)          | 1.0          | (8)          | 0.8          | (8)          |
| Cardiovascular diseases   | 0.6          | (5)          | 0.8          | (7)          | 0.7          | (7)          | 0.7          | (8)          |
| Respiratory diseases  | 0.5          | (5)          | 0.8          | (7)          | 0.6          | (5)          | 0.6          | (6)          |
| Chronic obstructive pulmonary disorder  | 0.4          | (4)          | 0.6          | (6)          | 0.5          | (4)          | 0.4          | (4)          |
| <b>Group III: Injuries</b>  | <b>5.2</b>   | <b>(49)</b>  | <b>5.2</b>   | <b>(50)</b>  | <b>6.6</b>   | <b>(58)</b>  | <b>5.0</b>   | <b>(51)</b>  |
| Unintentional injuries  | 2.3          | (22)         | 2.4          | (23)         | 2.0          | (17)         | 1.8          | (19)         |
| Intentional injuries  | 2.9          | (27)         | 2.8          | (27)         | 4.7          | (41)         | 3.2          | (32)         |
| Self-inflicted injuries   | 2.4          | (23)         | 2.7          | (25)         | 4.3          | (38)         | 3.1          | (31)         |
| <b>Other causes and ill-defined</b>   | <b>0.8</b>   | <b>(8)</b>   | <b>1.0</b>   | <b>(10)</b>  | <b>1.4</b>   | <b>(12)</b>  | <b>1.5</b>   | <b>(15)</b>  |
| <b>Smoking-related diseases</b>   | <b>2.0</b>   | <b>(19)</b>  | <b>1.8</b>   | <b>(17)</b>  | <b>1.7</b>   | <b>(15)</b>  | <b>1.3</b>   | <b>(13)</b>  |
| <b>Medically amenable causes</b>  | <b>1.0</b>   | <b>(10)</b>  | <b>0.9</b>   | <b>(8)</b>   | <b>0.4</b>   | <b>(4)</b>   | <b>0.8</b>   | <b>(8)</b>   |
| <b>Females</b>  |              |              |              |              |              |              |              |              |
| <b>Total difference (percent)</b>   | <b>8.6</b>   | <b>(100)</b> | <b>8.4</b>   | <b>(100)</b> | <b>10.7</b>  | <b>(100)</b> | <b>8.5</b>   | <b>(100)</b> |
| <b>Group I: Communicable, maternal, perinatal, and nutritional conditions</b> | <b>0.8</b>   | <b>(10)</b>  | <b>0.8</b>   | <b>(9)</b>   | <b>1.0</b>   | <b>(9)</b>   | <b>0.7</b>   | <b>(8)</b>   |
| Respiratory infections  | 0.3          | (3)          | 0.2          | (3)          | 0.3          | (3)          | 0.3          | (4)          |
| <b>Group II: Non-communicable diseases</b>                                    | <b>4.9</b>   | <b>(56)</b>  | <b>3.7</b>   | <b>(45)</b>  | <b>5.6</b>   | <b>(52)</b>  | <b>4.3</b>   | <b>(51)</b>  |
| Malignant neoplasms   | 1.1          | (12)         | 1.5          | (18)         | 2.6          | (24)         | 2.1          | (25)         |
| Trachea, bronchus, and lung cancers   | 0.9          | (10)         | 1.3          | (16)         | 1.5          | (14)         | 1.3          | (15)         |
| Cardiovascular diseases   | 1.1          | (13)         | 0.4          | (5)          | 1.0          | (9)          | 0.5          | (6)          |
| Respiratory diseases  | 2.1          | (25)         | 1.5          | (17)         | 1.4          | (13)         | 1.4          | (16)         |
| Chronic obstructive pulmonary disorder  | 1.7          | (19)         | 1.1          | (13)         | 1.2          | (11)         | 1.0          | (11)         |
| <b>Group III: Injuries</b>  | <b>1.7</b>   | <b>(20)</b>  | <b>1.9</b>   | <b>(22)</b>  | <b>2.4</b>   | <b>(22)</b>  | <b>1.8</b>   | <b>(21)</b>  |
| Unintentional injuries  | 1.0          | (12)         | 1.0          | (12)         | 1.2          | (11)         | 0.9          | (10)         |
| Intentional injuries  | 0.7          | (8)          | 1.0          | (11)         | 1.3          | (12)         | 1.0          | (11)         |
| Self-inflicted injuries   | 0.5          | (6)          | 0.8          | (10)         | 1.1          | (11)         | 0.8          | (10)         |
| <b>Other causes and ill-defined</b>   | <b>1.2</b>   | <b>(14)</b>  | <b>2.0</b>   | <b>(24)</b>  | <b>1.7</b>   | <b>(16)</b>  | <b>1.7</b>   | <b>(20)</b>  |
| <b>Smoking-related diseases</b>   | <b>2.9</b>   | <b>(34)</b>  | <b>2.7</b>   | <b>(32)</b>  | <b>2.8</b>   | <b>(26)</b>  | <b>2.6</b>   | <b>(31)</b>  |
| <b>Medically amenable causes</b>  | <b>0.9</b>   | <b>(10)</b>  | <b>0.4</b>   | <b>(5)</b>   | <b>1.2</b>   | <b>(11)</b>  | <b>0.6</b>   | <b>(7)</b>   |

Source: Person-years at risk pooled from mid-period census populations, 1989-1993; person-years at risk from annual demographic estimates, 1994-2008; deaths 1989-2008 from Vital Statistics Database, Deaths.

# An age- and cause-decomposition of differences in life expectancy between residents of Inuit Nunangat and residents of the rest of Canada, 1989 to 2008 • Research Article

amenable deaths made up 10% of the difference in 1989 to 1993 and 8% in 2004 to 2008.

For females, Group II - non-communicable causes contributed the most to the life expectancy gap. The largest component of this grouping was malignant neoplasms, accounting for 25% of the difference in life expectancy for 2004 to 2008. This was followed by respiratory diseases, notably, chronic obstructive pulmonary disease. Injuries contributed 20% of the inequality in 1989 to 1993 and 21% in 2004 to 2008. As a category by itself, smoking-related diseases were the primary contributor to the female life expectancy gap: 34% in 1989 to 1993, and 31% in 2004 to 2008. As was the case for males, medically amenable causes accounted for about 10% of the difference among females in most periods.

Figure 3 shows the contribution of each age group to the difference in life expectancy over the entire 1989-to-2008

period. For females, the major differences in life expectancy emerged later in life at ages 65 to 79. By contrast, the largest contributions for males occurred at ages 15 to 24.

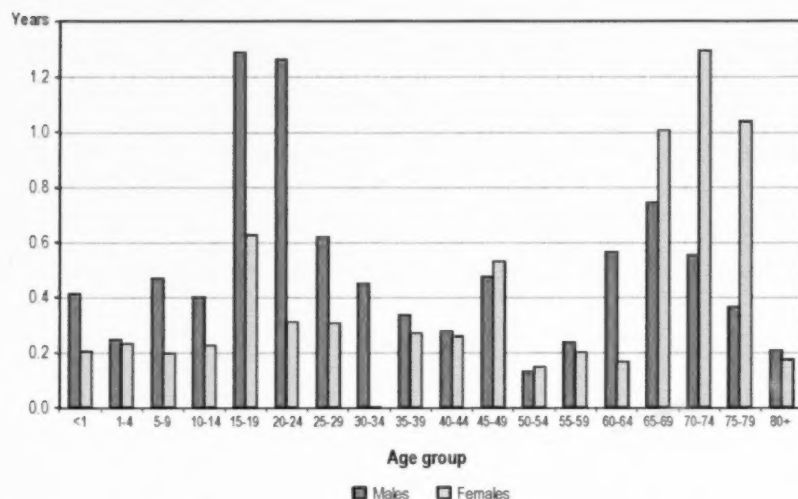
## Discussion

The results of this analysis offer a broader understanding of the diseases and conditions contributing to differences in life expectancy between residents of Inuit Nunangat and people in the rest of Canada. Injuries, particularly self-inflicted injuries, were the major contributor to the gap for males, and non-communicable diseases, notably smoking-related diseases, for females. For males, the age groups accounting for the largest share of the difference were the late teens and early 20s, largely because of high injury and suicide rates.<sup>24</sup> However, the largest mortality differences for females emerged at older ages,

reflecting chronic conditions that are the result of cumulative exposure.

Decomposition techniques have often been used to examine socio-economic differences in life expectancy, but relatively little research has been devoted to differences between Aboriginal and non-Aboriginal populations.<sup>25,26</sup> The findings of an Australian study that employed decomposition techniques to study life expectancy of Aboriginal and non-Aboriginal people<sup>26</sup> were similar to those reported here, with non-communicable diseases accounting for a large percentage of the difference. However, Group III (Injuries) did not play a

**Figure 3**  
Contribution in years to differences in life expectancy at birth between Inuit Nunangat and rest of Canada, by sex and age group, 1989 to 2008



Source: Person-years at risk pooled from mid-period census populations, 1989 to 1993; person-years at risk from annual demographic estimates, 1994 to 2008; deaths 1989 to 2008 from Vital Statistics Database, Deaths.

## What is already known on this subject?

- Life expectancy in Canada has been rising steadily over the past few decades and is among the highest in the world.
- Increases in longevity and decreases in mortality are not equal for all population groups or regions.
- Life expectancy for residents of Inuit Nunangat has been consistently lower than that estimated for people in the rest of Canada, while mortality and morbidity have been higher.

## What does this study add?

- Differences in life expectancy between residents of Inuit Nunangat and people in the rest of Canada can be attributed to specific causes occurring within defined age ranges.
- For males, the largest contributor to life expectancy differences is self-inflicted injury, primarily at ages 15 to 24.
- For females, the largest contributors to life expectancy differences are cancers and respiratory diseases occurring at ages 65 to 79.

# An age- and cause-decomposition of differences in life expectancy between residents of Inuit Nunangat and residents of the rest of Canada, 1989 to 2008 • Research Article

major role in the differences between Aboriginal and non-Aboriginal peoples in Australia, and intentional injuries for males were not significantly different between the two groups.

The present analysis has several limitations. First, the data pertain to the entire population of Inuit Nunangat, not only Inuit. Thus, the results cannot be interpreted as applying specifically to Inuit, but instead, to all residents of Inuit Nunangat. Second, registration of vital events among usual residents of Inuit Nunangat may be incomplete because few trauma or long-term care facilities were located there during the period examined. Residents often received critical and long-term care outside the

region, and as a result, some deaths of usual residents of Inuit Nunangat may not be registered as such. Third, data for the underlying population are from different sources. While improved population estimates were available for some years, they had to be augmented by census estimates when detailed estimates were not available. Fourth, health outcomes and health status differ among the four Inuit regions.<sup>27</sup> Some outcomes could be disaggregated by region, but the results are not presented here because the cause-of-death detail would be reduced. Finally, this analysis does not address the potential contributions of social determinants of health<sup>28</sup> or health services provision<sup>29</sup> to differences in life expectancy.

## Conclusion

The results of this study indicate that differences in life expectancy between residents of Inuit Nunangat and the rest of Canada can be attributed to specific cause groups occurring within defined age ranges. For males, the largest contributor to life expectancy differences was self-inflicted injury, primarily at ages 15 to 24. For females, the largest contributors were cancers and respiratory diseases occurring at ages 65 to 79. Respiratory diseases are often related to smoking-related diseases, which as a category, accounted for the largest percentage of the difference in female life expectancy. Such information can aid health practitioners and policy-makers in addressing the origins of the life expectancy gaps between residents of Inuit Nunangat and people in the rest of Canada. ■

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**An age- and cause-decomposition of differences in life expectancy between residents of Inuit Nunangat and residents of the rest of Canada, 1989 to 2008 • Research Article**

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